MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

EET1156 – BASIC ELECTRICAL TECHNOLOGY
(ME)

9 MARCH 2017
2:30 PM – 4:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages including cover page with 5 Questions only.

2. Attempt **ALL** the questions. The distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

a) Determine v_a of the circuit in Figure Q1(a).
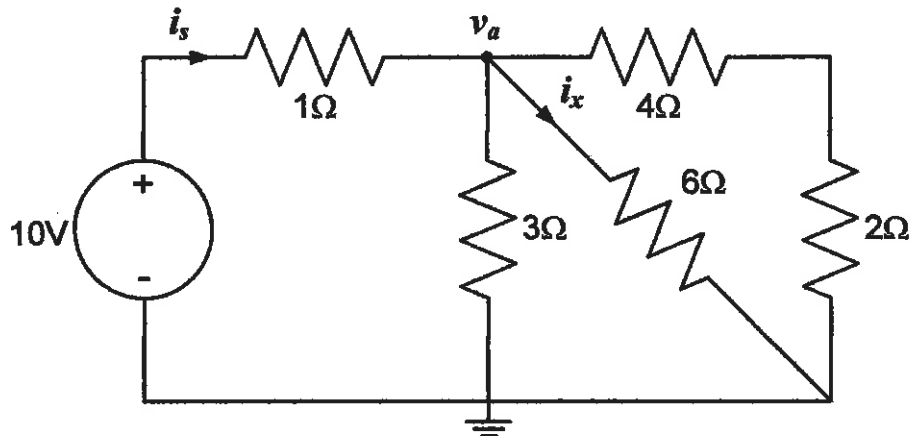   Then solve for i_s and compute the current i_x.

Figure Q1(a)

[8 marks]

b) Perform *mesh analysis* to determine the mesh currents I_1, I_2 and I_3 of the circuit in Figure Q1(b). [Follow the mesh directions given].
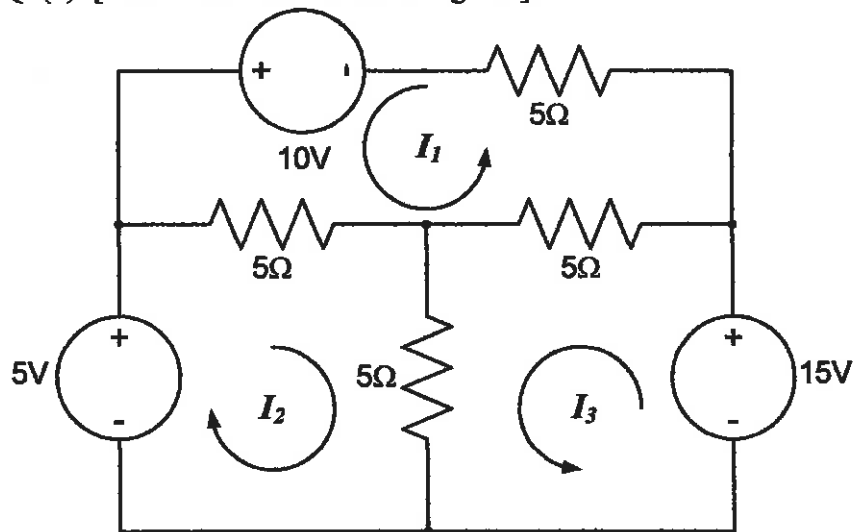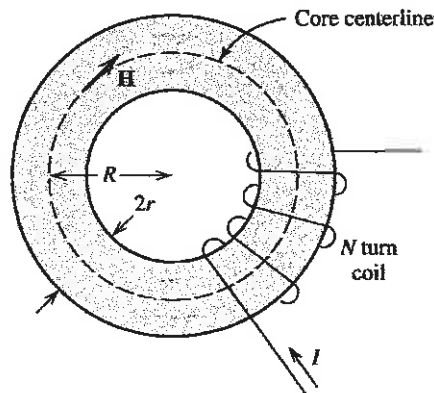

Figure Q1(b)

[12 marks]

Continued...

Question 2

a) In a parallel plate capacitor with air between 2 plates, the cross section area is $6 \times 10^{-3} m^2$ and the separation between the plates is 5mm.

   i. Calculate the capacitance of the capacitor   [2 marks]

   ii. If this capacitor is connected to 120V supply, what would be
the charge on each plate?   [2 marks]

   iii. How would charge on the plate be affected if a 5mm thick mica
sheet of $\varepsilon_r = 6$ is inserted between the plates while the voltage supply
remains connected.   [2 marks]

   iv. What is the flux density in (iii)?   [2 marks]

b) The coil in Figure Q2 has 150 turns and is wound on a silicon sheet steel with a diameter of 4cm. The mean radius, R is 10cm and the toroidal core has a circular cross section. If this toroidal carries the coil current of 2A and permeability of the core is given of 3×10^{-3}. Determine the

   i. cross section area, A.   [2 marks]

   ii. reluctance of the toroidal.   [2 marks]

   iii. magnetic flux density, B.   [4 marks]

   iv. intensity, H and mmf, F.   [4 marks]

Figure Q2

Continued...

Question 3

a) Figure Q3(a) is a circuit with $R_1 = 8\ \Omega$, $C_1 = -j2\ \Omega$, $L_1 = j4\ \Omega$, $R_2 = 6\ \Omega$, a current source with $I = 6\angle 0^0$ A and a voltage source with $V = 30\angle 30^0$ V. The arrow above the current source indicates the current flow orientation. Determine I_o.

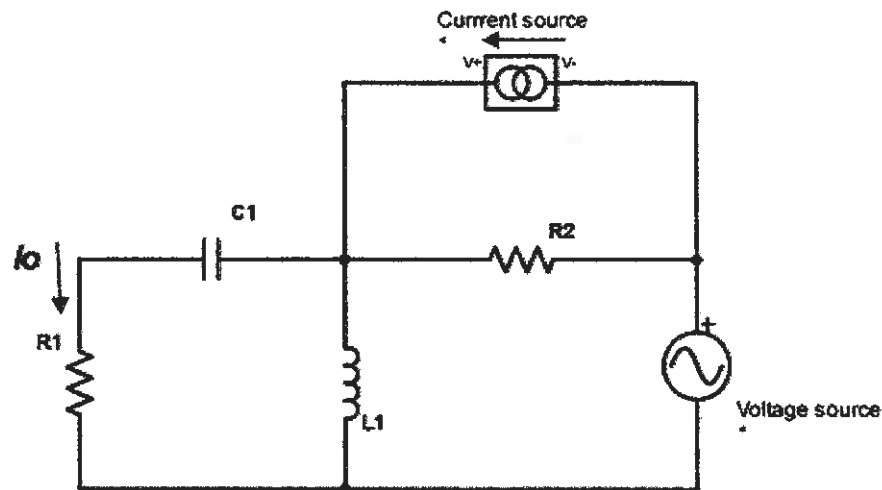**Figure Q3(a)**

[8 marks]

b) Given the current source has $I = 30\sin 2t$ A, resistor $R_1 = 2\ \Omega$, resistor $R_2 = 4\ \Omega$, inductor $L_1 = 2$ H, capacitor $C_1 = 0.2$ F and the DC voltage source has an amplitude $3V_x$, determine V_1 and V_2 using *nodal analysis*. [Hint: use nodal analysis and matrices to solve for the final answer].
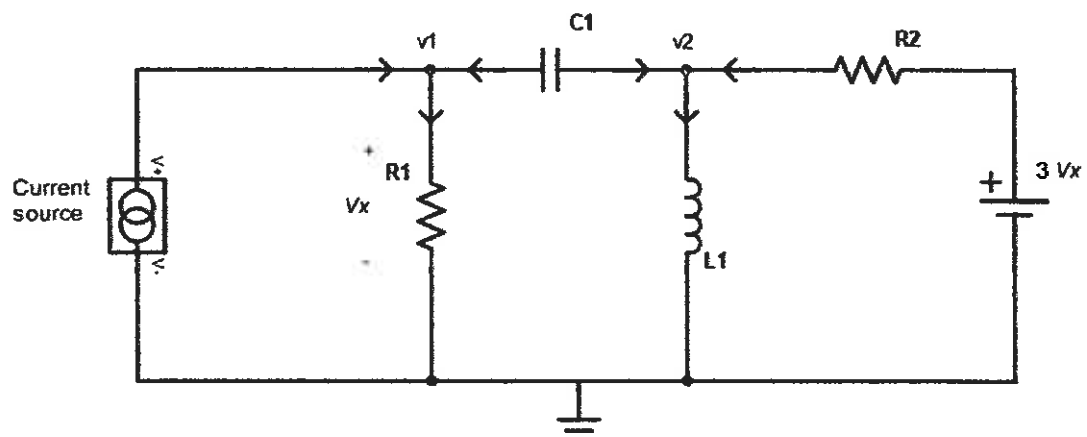

Figure Q3(b)

[12 marks]

Continued...

Question 4

a) Figure Q4(a) shows a parallel diode configuration circuit where $R_1 = 600\ \Omega$ and E has an amplitude of 20 V. Solve for V_o, I_1, I_{D1} and I_{D2} assuming both diodes, D_1 and D_2 have similar characteristics.
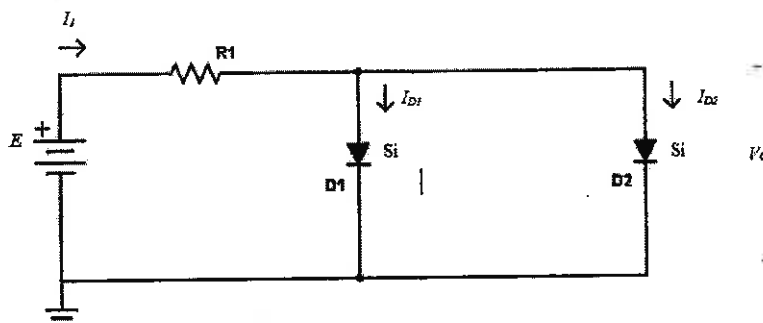

Figure Q4(a)

[6 marks]

b) Figure Q4(b) shows a *fixed-bias configuration* where $V_{CC} = +10$ V, $R_1 = R_B = 400$ kΩ, $R_2 = R_C = 1.8$ kΩ and $C_1 = C_2 = 10$ μF. Assume $R_3 = R_E = 0\ \Omega$ (short circuited), C_3 is a fully discharged capacitor (short circuited) and $\beta = 60$. Determine the following:

   i. I_B and I_C [3 marks]
   ii. V_{CE} [3 marks]
   iii. V_B and V_C [3 marks]
   iv. V_{BC} [2 marks]
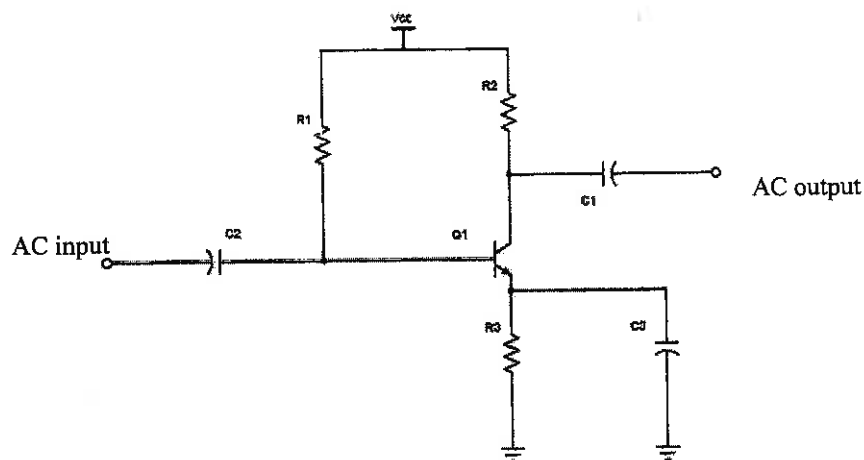   v. I_{CSAT} [2 marks]
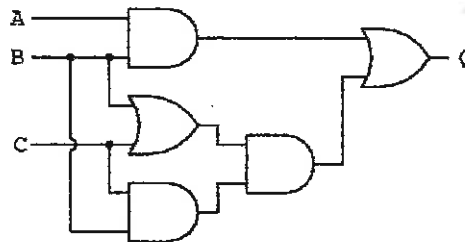

Figure Q4(b)

c) Briefly describe the six characteristics of an *ideal operational amplifier*.

[6 marks]

Continued...

Question 5

a) *"I will take an umbrella with me if it is raining or the weather forecast is bad."*
    Based on this statement, compute a truth table to fulfil the conditions.   [4 marks]

b) Simplify the logic circuit in Figure Q5 using *Boolean logic*.   [4 marks]

Figure Q5

c) Given the following equation,
$$Y = \overline{ABCD} + \overline{A}BC\overline{D} + \overline{AB}C\overline{D} + \overline{A}BCD + B\overline{CD} + BC\overline{D} + A\overline{BCD} + A\overline{B}D + A\overline{BC}\overline{D}$$
    solve for the simplest logic expression using *Karnaugh Map*.

                                                                        [7 marks]

End of paper.